Duration: 3Hrs **Marks:80**

Instructions:

i) Question No.1 is compulsory
ii) Solve any three questions from the remaining
iii) Assume suitable data wherever necessary
iv) Figure to the right indicates marks.

Q.1 Solve **any four** questions from following

a) Explain controlling force diagram of governor? **(05)**

b) Derive an expression for effect of gyroscopic couple on a naval ship during pitching. **(05)**

c) Explain why mechanical vibration is an important area of study for engineers. Briefly describe five practical examples of good vibration. **(05)**

d) Draw and explain a plot of magnification factor versus frequency ratio curves for various damping factor values. **(05)**

e) Explain static and dynamic balancing. **(05)**

Q.2 a) The inertia of the connecting rod can be replaced by two masses concentrated at two points and connected rigidly together. How to determine the two masses so that it is dynamically equivalent to the connecting rod? **(10)**

b) Find the natural frequency of the pulley system shown in figure1 by neglecting friction and masses of pulleys **(10)**

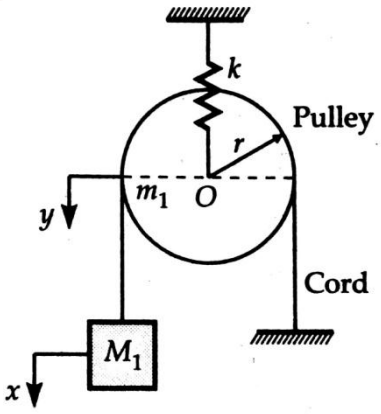

Figure1

Q.3 a) Explain the various types of instrumentation system for condition monitoring. **(10)**

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b) The disc of torsional pendulum has moment of inertia 600 kg-cm2 and is immersed in a viscous fluid. The brass shaft attached to it is of 10cm diameter and 40cm long. When the pendulum is vibrating, the observed amplitudes on the same side of the rest position for successive cycles are 90, 60 and 40. Determine a) logarithmic decrement b) damping torque at unit velocity c) time period. Assuming for brass G=4.4×1010 N/m2. **(10)**

Q.4 a) A vertical petrol engine 100 mm diameter and 120 mm stroke has a connecting rod 250 mm long. The mass of the piston is 1.1 Kg. The speed is 2000 r.p.m. On the expansion stroke with a crank 20^0 from top dead centre, the gas pressure is 700 KN/mm^2. Determine net force on the piston, resultant load on the gudgeon pin, thrust on the cylinder wall, speed above which other things remain same, the gudgeon pin load would be reverse in direction. **(10)**

b) A machine of mass 50 Kg operates at 1200 r.p.m. Find the maximum stiffness of an isolator that provides 75 percent isolation. Assume that damping ration of the isolator 7 percent. **(10)**

Q.5 a) Derive the equation for critical speed of a light shaft with a single disk without damping. **(10)**

b) A vehicle moves over a road surface having approximately the sinusoidal profile with a wavelength of 10 m and amplitude of 80 mm. The vehicle is moving with a velocity of 55 km/hr. Calculate the critical speed of the vehicle. If the amplitude of vibration is 25 mm and mass of vehicle is 500 kg. **(10)**

Q.6 a) A shaft supported between bearings 2 m apart and extended 0.5 m beyond bearing at each end. The shaft carries three pulleys one at each end and one at the middle of its length. The masses of end pulleys are 50 kg and 25 kg and there centre of gravity are 20 mm and 15 mm respectively from the shaft axis. The centre pulley has a mass of 60 kg and it's cetre of gravity is 20 mm from the shaft axis. If the pulleys are arranged so as to give the static balance, determine the angular position of the pulleys and the dynamic force produced on the bearing when the shaft rotates at 340 r.p.m. **(10)**

b) A Hartnell governor having a central sleeve spring and two right angled bell crank levers moves between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15 mm. The sleeve arms and the bell arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and the mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine loads on the spring at the lowest and the highest equilibrium speed and stiffness of the spring. **(10)**

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